

Alternative Methods for Estimating ESALs

FHWA Pooled Funds Study SPR 2(193)

presented by

Herbert Weinblatt

Richard A. Margiotta

Harry Cohen

William A. Perez

May 2002

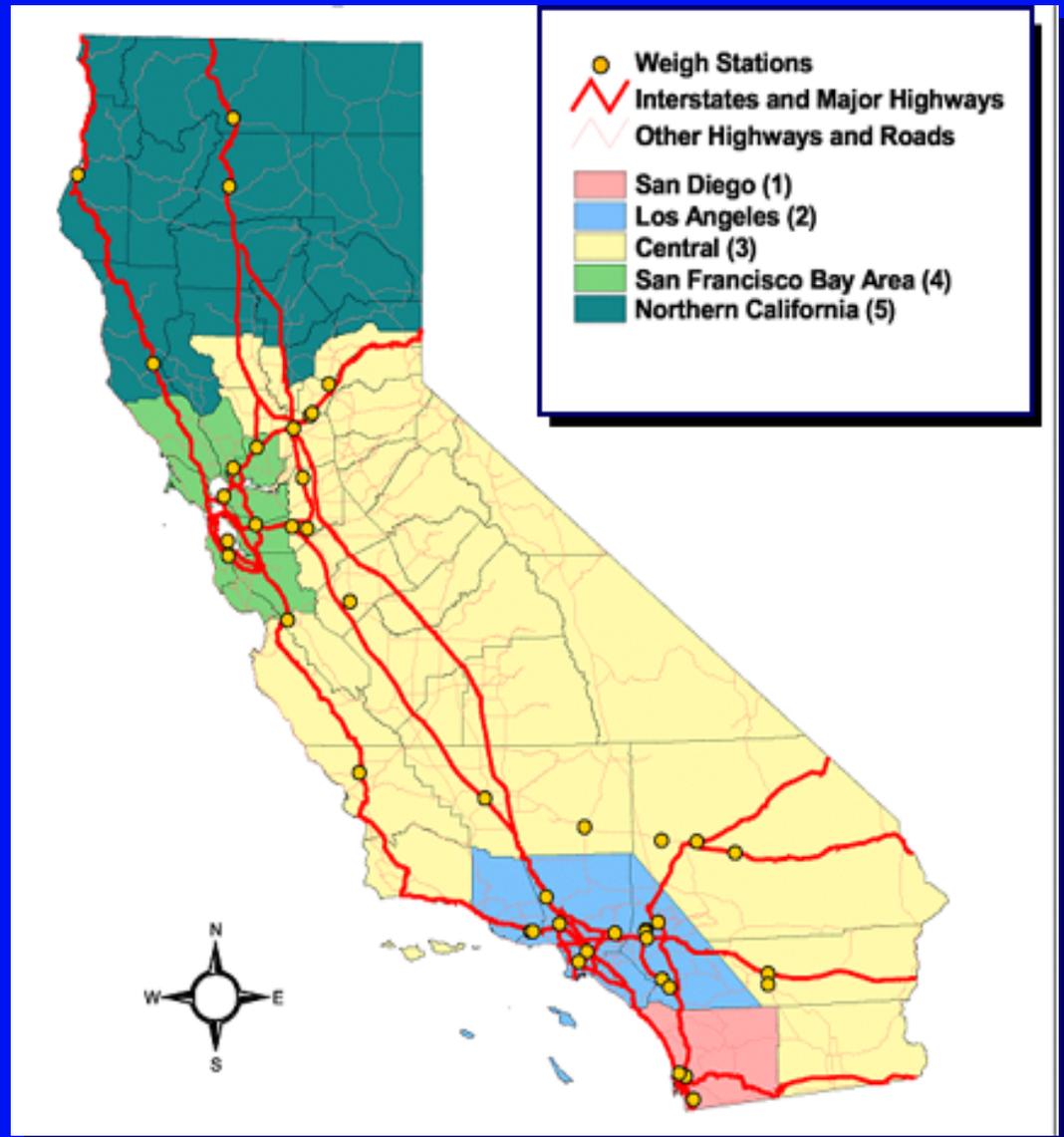
Goal

**Evaluate Alternative Procedures
for Estimating Average
ESALs/Vehicle at a Given Site**

Data

- **California WIM data for 2000**
- **99 sites**
- **Used data from**
 - **19 sites with 12 months of data**
 - **36 sites with 10 or 11 months of data**
 - **55 sites in all**

California Weigh Stations by Region



Average ESALs Per Vehicle by Functional Class (Site Average Approach)

	Average ESALs Per Vehicle		
	Vehicle Class 5	Vehicle Classes 6-7	Vehicle Classes 8-13
Rural Interstate	0.123	0.426	1.090
Rural Other	0.118	0.377	0.958
Urban Interstate	0.147	0.493	0.741
All Sites	0.139	0.470	0.842

Averaging

- “All vehicles approach” – simple average of ESALs for all vehicles (in the state, FC, or region)
- “Site average approach” –
 - Get separate averages for each site
 - Get average of these “site averages”

For combinations, sites with the highest traffic volumes also tend to have the heaviest vehicles

Average ESALs Per Vehicle by Functional Class (Site Average Approach)

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Rural Interstate	0.123	0.426	1.090
Rural Other	0.118	0.377	0.958
Urban Interstate	0.147	0.493	0.741
All Sites	0.139	0.470	0.842
All Sites (all vehicles appr.)	0.145	0.464	0.900

Average ESALs Per Vehicle by Region (Site Average Approach)

	Average ESALs Per Vehicle		
	Vehicle Class 5	Vehicle Classes 6-7	Vehicle Classes 8-13
1. San Diego	0.142	0.746	0.807
2. Los Angeles	0.151	0.462	0.738
3. Central	0.124	0.395	0.912
4. Bay Area	0.145	0.465	0.742
5. North	0.139	0.440	1.270
All Sites	0.139	0.470	0.842

Using Default Values

Mean Absolute Percent Error (MAPE)

Vehicle
Class 5

Vehicle
Classes 6-7

Vehicle
Classes 8-13

Site Average Approach

Statewide Avgs	18.2%	31.4%	25.4%
Functional Class Avgs	17.5%	32.2%	21.6%
Regional Avgs	17.9%	28.0%	21.9%

All Vehicles Approach

Statewide Avgs	20.2%	30.9%	28.7%
Functional Class Avgs	18.4%	30.7%	21.3%
Regional Avgs	19.5%	26.5%	23.6%

Using Site Specific Data (48 Hours)

Mean Absolute Percent Error (MAPE)

	Vehicle Class 5	Vehicle Classes 6-7	Vehicle Classes 8-13
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<i>Unfactored</i>	8.5%	13.2%	8.0%
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Factored Using Site Average Approach

Statewide Factors	7.4%	12.9%	7.3%
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Functional Class Factors	7.5%	13.8%	7.3%
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Regional Factors	7.5%	13.7%	7.5%
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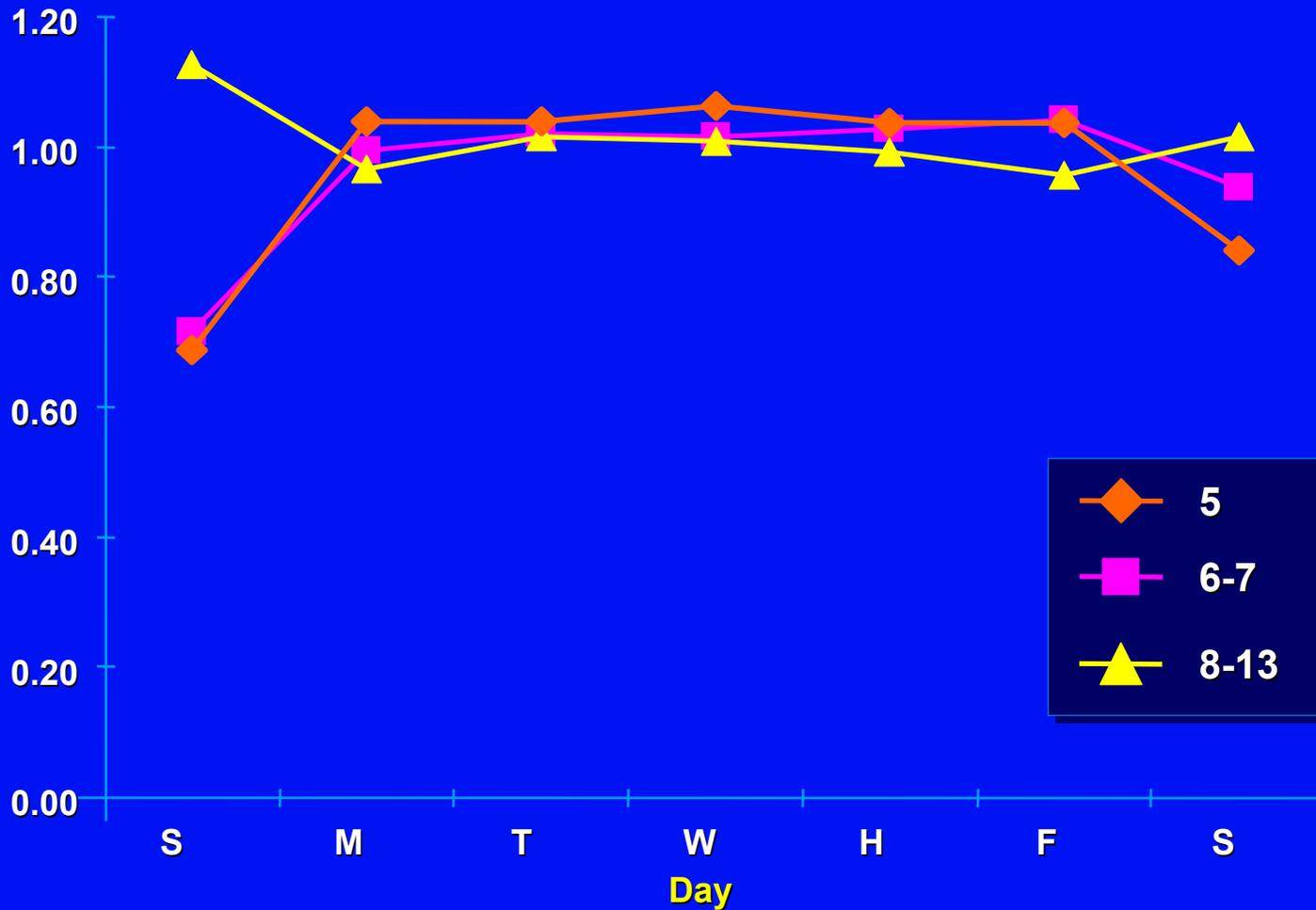
Factored Using All Vehicles Approach

Statewide Factors	7.6%	13.0%	7.1%
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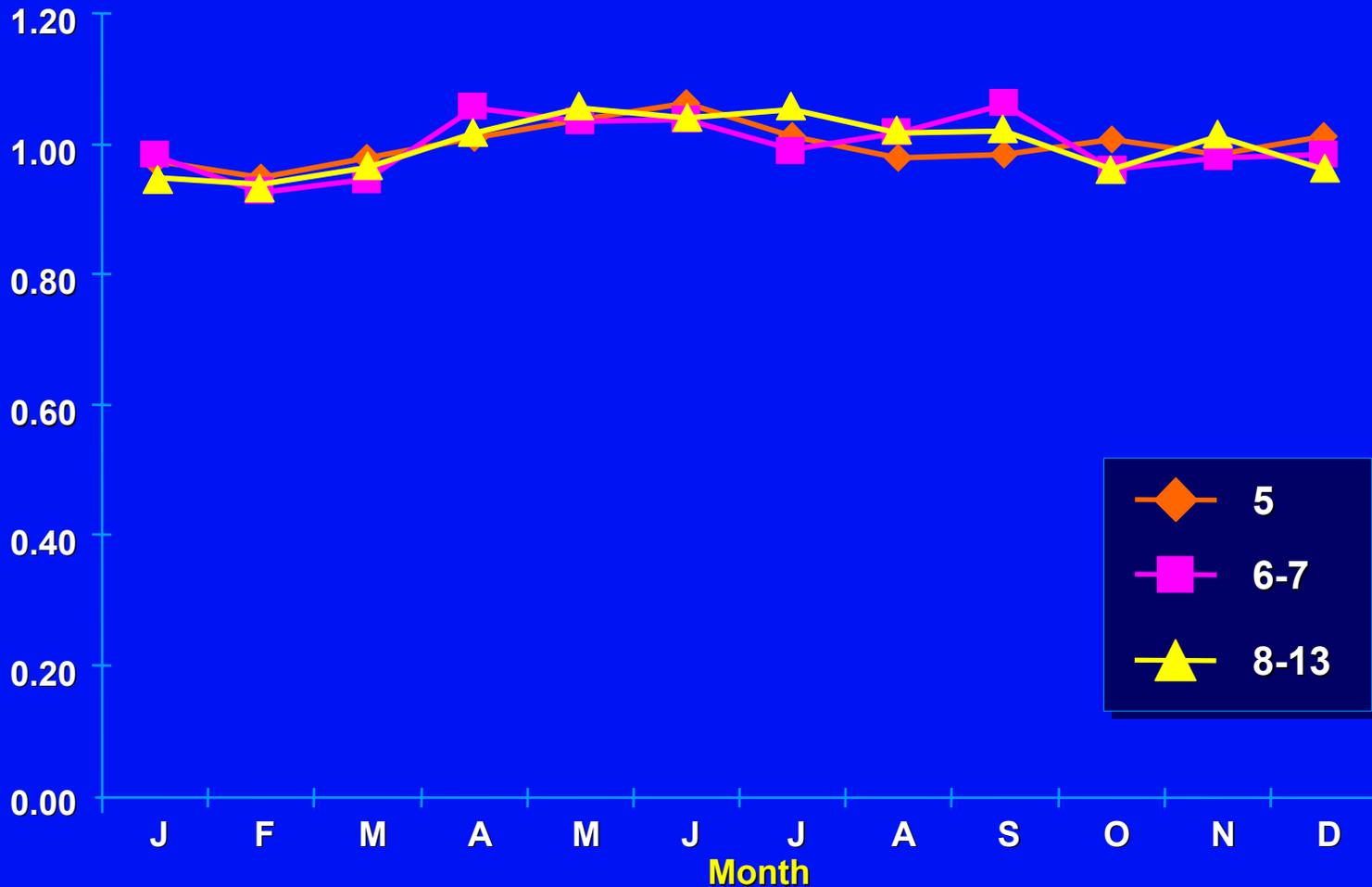
Functional Class Factors	7.8%	13.8%	7.3%
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Regional Factors	7.6%	13.9%	7.4%
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Day of Week Load Variation



Seasonal Load Variation



Summary of Results

Alternate Sources of ESALs Estimates	Estimated MAPE
1. In-pavement WIM at site (48 hours) – factored	7%
2. In-pavement WIM at site (48 hours) – unfactored	8%
3. WIM in poor pavement at site (48 hours)	?
4. Portable WIM at site (24 or 48 hours)	?
5. Regional Defaults	22%
6. Statewide Defaults	25%

Future Analyses

- Use statewide monthly factors to input values for missing months; then repeat analyses using a larger set of sites
- Test AASHTO three-step averaging procedure
- Evaluate alternative regional and/or functional-class groupings
- **Use of site-specific data collected over seven days**